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SHORT REPORT

Aortic Surgery Complications Evaluated by an Implanted Continuous Electrocardiography Device: A Case Report

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Heart rhythm monitoring;
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Abstract *Introduction:* Cardiac arrhythmias are a major cause for morbidity and mortality in patients undergoing non-cardiac vascular surgery.
Report: An implantable loop recorder (Reveal® XT) was used for continuous heart rhythm monitoring to detect perioperative arrhythmias in a 69-year-old man undergoing major vascular surgery for an infected aortobifemoral prosthesis. The Reveal® detected several episodes of asymptomatic new-onset atrial fibrillation postoperatively, associated with elevated serum levels of troponin-T and N-terminal pro-B-type natriuretic peptide NT-proBNP).
Discussion: Continuous heart rhythm monitoring with assessment of serum cardiac biomarkers may allow early identification and treatment of patients at high risk of perioperative cardiovascular complications, in particular, cardiac arrhythmias.

Introduction

Cardiovascular complications are a major cause for morbidity and mortality in vascular surgery patients.[1] In addition to ischaemic complications, up to 20% of patients develop cardiac arrhythmias postoperatively, of which atrial fibrillation (AF) is the most common form. Consequences of cardiac arrhythmias include sudden cardiac death, congestive heart failure (CHF) and stroke.[2] Due to their asymptomatic and atypical character, the majority of these perioperative arrhythmias are missed, and, hence, undertreated.[2] We hypothesise that continuous heart rhythm monitoring could identify patients with cardiac arrhythmias, and present their relation with cardiac serum biomarkers.

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Case Report

A 69-year-old man presented with an infected prosthetic aortobifemoral graft. His medical history was positive for cardiovascular risk factors,[3] including diabetes, hypertension, coronary artery reconstruction, and an aortic bifurcation graft for stenotic aortoiliac disease. Preoperative test showed normal renal function.[4] He was admitted with fever and blood cultures positive for *Streptococcus anginosus*. Computed tomography (CT) angiography revealed an intimate connection between the aortic graft and the duodenum accompanied by fluid collections, consistent with prosthesis infection. The decision was made to remove the infected graft. The patient had no history of arrhythmias, and at preoperative work-up, his electrocardiograph (ECG) showed normal sinus rhythm (SR). Dobutamine echocardiography demonstrated a reduced left ventricular ejection fraction (LVEF 30—40%), septal hypokinesia, but no stress-inducible ischaemia. Preoperative serum cardiac troponin-T (cTnT) was within normal limits, whereas *N*-terminal pro-b-type natriuretic peptide (NT-proBNP) was elevated (1191 pg ml^{-1}).

Two days prior to surgery, an implantable loop recorder (ILR; Reveal® XT, Medtronic Inc., Minneapolis, MN, USA) was implanted subcutaneously for continuous heart rhythm monitoring. To detect myocardial ischaemia, continuous 12-lead ECG monitoring (Holter) was performed. Prior to surgery, the Reveal® device was read, showing no arrhythmias. The infected aortic prosthesis was removed with venous patch angioplasty of the common femoral arteries[3]. As there were no signs of acute limb ischaemia, in the presence of partially patent iliac arteries, no central reconstruction was performed during the index procedure.

The day after surgery, the patient developed new-onset paroxysmal AF, not responding to chemical cardioversion with amiodarone. He was converted electrically, after removal of the Holter monitor, at days 1 and 3 after surgery. At the end of day 3, the patient developed peritonitis requiring a relaparotomy with partial duodenectomy and duodenojejunostomy. After a prolonged septic period and intensive care unit (ICU) stay, the patient eventually recovered and was discharged with anticoagulation, beta blocker and statin therapy. A below-the-knee amputation was performed 4 months after the index procedure for irreversible ischaemia of the right forefoot.

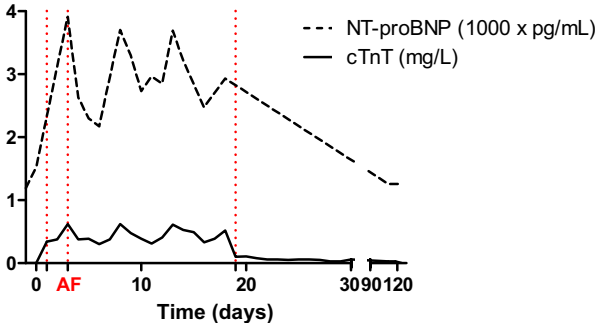

Figure 1 Perioperative biomarker measurement and detection of AF.

Although postoperative Holter and standard 12-lead ECG recording showed no signs of myocardial ischaemia, serum levels of cTnT peaked at days 3, 8, 13 and 18 postoperatively to a maximum of 0.62 $\mu g\ l^{-1}$ in the absence of chest pain (Fig. 1). Postoperative levels of NT-proBNP showed a similar pattern. Interestingly, Reveal® showed that episodes of AF were paralleled by peaks in serum cTnT and NT-proBNP levels. The last episode of paroxysmal AF was detected 19 days after the index surgery, and the patient returned to SR afterwards. Despite electrical cardioversion, the Reveal® recordings remained of good quality.

Discussion

This case shows that continuous heart rhythm monitoring has excellent recording quality and could improve the detection of perioperative arrhythmias.

The incidence of arrhythmias depends on the type of cardiac monitoring, with better estimates being obtained using continuous monitoring. In a study by Mathew et al., it was noted that continuous ECG monitoring diagnoses 76.8% of perioperative arrhythmias, whereas intermittent 12-lead ECG or physical examination detect only 17.5% and 12.8%, respectively.[5] In our case, continuous monitoring was performed with an ILR. The Reveal® device is easily implanted in a subcutaneous pocket in a left parasternal position at the level of the 4th or the 5th intercostal space, in less than 30 min. The device can be left *in situ* up to 3 years after implantation and sustains electrocardioversion.

Strikingly, the episodes of AF were paralleled with increased levels of cTnT and NT-proBNP. With respect to the underlying pathophysiological mechanism, we suggest that subclinical myocardial ischaemia, as revealed by increased serum cTnT, induces cardiomyocyte contractile dysfunction, resulting in cardiomyocyte stretch and release of NT-proBNP. Furthermore, cardiomyocyte stretch is associated with myocyte depolarisation during diastole, changing the action potential and causing abnormal impulses by stretch-activated channel currents, which may trigger arrhythmias.[5] Transient and asymptomatic new-onset AF during vascular surgery has been shown to be associated with a fivefold increased risk for perioperative and long-term cardiovascular events.[1]

In conclusion, continuous heart rhythm monitoring with assessment of cardiac biomarkers may allow early identification and treatment of patients at high risk of perioperative cardiovascular complications, in particular, cardiac arrhythmias.

Conflict of Interest/Funding

None.

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